



# STUDIES

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## RACE, EDUCATION, AND MORTALITY IN NORTH CAROLINA

by

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### ABSTRACT

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Higher mortality among blacks in the United States and among persons of lower socioeconomic status have been well documented. There has been less research on the interaction of race and socioeconomic status with regard to mortality. The present study addresses this issue. The major objective is to determine if racial differences in mortality remain after controlling for socioeconomic status, as measured by education. Death certificate data for 1989-91 were combined with 1990 census data on population to compute age-adjusted mortality rates by race-sex group and educational level for persons age 25 and over.

It was found that blacks had substantially higher age-adjusted mortality at every level of education. Significant mortality differences by education were observed in each race-sex group. The largest mortality differences between racial groups and between higher and lower educational groups were found at the youngest ages. The limitations of using education as an indicator of socioeconomic status are discussed.

A number of factors could be responsible for the racial differences in mortality that persist after controlling for education. These may include more limited health care access for blacks, different income and occupational characteristics for blacks at the same educational level as whites, and racism and racial discrimination resulting in a variety of negative outcomes including increased stress and associated health problems.





## INTRODUCTION

Blacks in the United States have been shown to have overall higher mortality rates than whites<sup>1,2,3</sup>. The relationship between socioeconomic status and mortality is well established: persons in lower socioeconomic strata have generally higher mortality rates than persons at higher socioeconomic levels<sup>1,4,5,6,7,8,9,10</sup>. There has been less research on the interaction of race and socioeconomic status with regard to mortality, and the results of such studies have been inconsistent.

Some research has suggested that racial differences in mortality are primarily a function of the lower socioeconomic status of blacks and that racial differences greatly diminish or disappear after controlling for socioeconomic status<sup>11</sup>. The study by Keil, et al.<sup>11</sup> was, however, limited by a small sample size and was restricted to a narrow geographic area. A study by Nelson<sup>5</sup> showed no significant differences in mortality between black and white children at a very low level of poverty. Other studies have concluded that significant racial differences in mortality remain after controlling for traditional measures of socioeconomic status<sup>3,12</sup>. Otten<sup>3</sup> found that 31 percent of the excess mortality among black adults could be explained by six well-established risk factors and 38 percent could be explained by family income, but that 31 percent of the racial difference in mortality remained unexplained.

The present study uses statewide data for a three-year period to examine race and socioeconomic status in relation to mortality in North Carolina. The following questions are addressed: To what extent are there still racial differences in mortality after controlling for socioeconomic status? To what extent are there socioeconomic differences in mortality **within** race groups in North Carolina? How do racial and socioeconomic differences in mortality vary by age?

## METHODS

A key issue in a study such as this is how to define socioeconomic status. Traditional choices are

income, occupation, and education. Income and occupation have a key limitation when studying the relationship of socioeconomic status to health. Declining health may cause loss of income and downward mobility in occupation. Thus the direction of causation between health (measured by mortality) and these measures of socioeconomic status may be blurred. Education has the advantages of being fixed fairly early in life (usually by age 25) and of not being affected by the approach of death (except at young ages). Therefore, education is used as a measure of socioeconomic status in the present study. Education may be considered one dimension of socioeconomic status which is only partially correlated with other dimensions such as occupation and income.<sup>1,13</sup>

This study uses population data from the 1990 Census and death certificate data for 1989-91 to calculate death rates by race and education for North Carolina. This basic approach was recommended in the landmark study of differential mortality by Kitagawa and Hauser<sup>1</sup>. Not until 1988 was education of decedent added as an item on the death certificate, so this type of study was not possible in North Carolina for earlier years. Occupation was recorded on the death certificate in North Carolina prior to 1988, but, in addition to the problem cited above, occupation on the death certificate is the **usual** occupation during the decedent's lifetime while **current** occupation is reported in the population census, which may result in considerable discrepancies.

The educational categories used for this study were based on the categories in the available census data, and are generally consistent with those in other studies. These categories are defined in terms of completed years of education: 0-8, 9-11, 12, and more than 12. It would have been desirable to break out more categories above 12 years of education, but incompatibilities between the death certificate and census data prevented doing this. Education on the death certificate is defined strictly in terms of years of education ("highest grade completed", usually reported by next of kin) while the census data



(self-reported) are oriented to diploma attainment. For example, census categories are "9th to 12th grade, no diploma" and "high school graduate." We have assumed that most people completing 12 years of education will have graduated from high school and therefore that the categories 9-11 and 12 on the death certificate are generally compatible with the census categories. For college, however, more people are likely to complete 16 years of education (4 past high school) and not get a diploma. The available census categories are "some college, no degree" and "bachelor's degree." Therefore, to reduce error, all educational levels above high school have been combined into one category.

The racial groups examined in this study are white and black; American Indian and Asian deaths were omitted due to small numbers of deaths. To analyze differences that may occur across race-sex groups, the data are generally broken out into four major demographic categories: white male, white female, black male, and black female. The census population counts for 1990 were multiplied by three to form the denominators of the 1989-91 death rates. Deaths and census data only for persons age 25 and over were used to calculate the rates, since education is usually fixed by that age.

One problem with the educational information on the death certificate is that there is a large amount of missing data. During 1989-91, 16 percent of the death records for whites had missing education while for blacks the percentage missing was 15. We have left deaths with missing education out of the death rates presented in the Results section. If the distribution of these deaths with missing education is essentially random, then the size of the death rates will be reduced somewhat but the comparisons by race-sex and education will not be biased. The age-race-sex distribution of these deaths with missing education is very similar to the age-race-sex distribution of deaths with known education during 1989-91, though slightly shifted toward the 75+ age group.

A critical factor incorporated into this study is age adjustment of the death rates. Rates for race-

sex-education groups were adjusted to the age distribution of the total population (white plus black) using the direct method of age adjustment. Age-specific rates for the adjustment process were computed for the seven age groups of the available census data: 25-34, 35-44, 45-54, 55-59, 60-64, 65-74, and 75+. The 1989-91 age-specific numbers of deaths used in the adjustment process were, with a very few exceptions, much larger than 100. Therefore, the rates computed with these numerators will be relatively stable from a statistical standpoint. The age distribution differs drastically by educational category; persons with low education are much older on average than persons with higher education. To ignore age adjustment would be to attribute to education what is predominantly an age effect. Also, blacks in North Carolina have a younger age distribution than whites, which tends to lower their unadjusted death rate. The importance of age adjustment will be illustrated clearly in the data presented in the Results section.

Only overall death rates are examined in this study. We are not testing any hypotheses about how the results might vary by cause of death. Serious problems of statistical instability could result from computing death rates for cause-specific categories, which may have a very small number of deaths.

## RESULTS

Table 1 presents data on the 1990 resident population of North Carolina age 25 and over. These census data (multiplied by three) are used as the denominators of the 1989-91 mortality rates in this study. Table 1 shows that blacks have generally lower educational levels than whites; for example, the percentages of the population with less than a high school education are 43 and 41 for black males and black females, compared to 27 for both white males and white females. A striking finding in Table 1 is the much higher average age of persons in the lower educational groups. This underscores the importance of adjusting mortality rates for age when making comparisons among educational groups. Also, except for the lowest educational group, blacks are



**Table 1**

**North Carolina 1990 Population Age 25 and Over  
by Race-Sex Group by Education, With Average Age  
(From 1990 Census)**

<u>Education</u>	<u>White Males</u>			<u>White Females</u>			<u>Black Males</u>			<u>Black Females</u>		
	<u>Number</u>	<u>%</u>	<u>Avg. Age</u>	<u>Number</u>	<u>%</u>	<u>Avg. Age</u>	<u>Number</u>	<u>%</u>	<u>Avg. Age</u>	<u>Number</u>	<u>%</u>	<u>Avg. Age</u>
0-8 years	186,886	11.8	61.3	189,917	10.8	66.6	70,324	19.4	61.5	76,449	16.6	66.2
9-12 years, no diploma	246,225	15.5	49.5	277,241	15.8	54.5	85,652	23.6	44.9	112,037	24.3	49.1
High school graduate	426,580	26.9	45.3	548,818	31.3	49.0	107,188	29.6	39.5	129,648	28.2	42.3
Some college	728,455	45.8	44.1	739,566	42.1	44.7	99,323	27.4	40.0	142,133	30.9	40.5
Total	1,588,146	100.0	47.3	1,755,542	100.0	50.0	362,487	100.0	45.2	460,267	100.0	47.4

**Table 2**

**1989-91 North Carolina Unadjusted Death Rates  
(per 100,000 population)  
by Race-Sex Group by Education**

<u>Years of School Completed</u>	<u>Females</u>				<u>Males</u>			
	<u>White</u>	<u>Black</u>	<u>Total</u>	<u>Black/White Ratio</u>	<u>White</u>	<u>Black</u>	<u>Total</u>	<u>Black/White Ratio</u>
0-8	2950.2	2935.3	2945.9	.99	3260.8	3771.6	3400.5	1.16
9-11	1431.0	962.5	1296.2	.67	1649.4	1494.8	1609.5	.91
12	682.0	758.7	696.6	1.11	987.5	1248.0	1039.8	1.26
More than 12	500.6	410.6	486.1	.82	546.7	523.9	544.0	.96
Total	969.2	1062.4	988.6	1.10	1155.5	1597.5	1237.6	1.38

shown to be substantially younger than whites on average, which points to the need for age adjustment when comparing the mortality rates of whites and blacks.

Table 2 shows unadjusted 1989-91 mortality rates by race, sex, and education. The mortality rates of persons with 0-8 years of education are generally six times as high as the rates of persons with more than a high school diploma. There is a steady decline in mortality with increasing education. The mortality rates for males are consistently higher than those for females. Also, black unadjusted mortality rates are not generally higher than those for whites.

The age-adjusted mortality rates in Table 3 show a much different pattern. There is an overall decline in mortality with increasing education, though the differences are much less after age

adjustment. Persons with 0-8 years of education have mortality rates around 1.5 times the rates of persons with more than high school education. Blacks have consistently higher mortality than whites, at each educational level, and this effect is stronger for males. Thus, the racial differences in mortality in North Carolina are not explained by the lower levels of education, on average, among blacks. Statistically adjusting the mortality rates of blacks and whites for both age and education (using the direct method of adjustment, data not shown here) also resulted in very little reduction in the overall racial differential in age-adjusted mortality. There are also much higher mortality rates among males, for both whites and blacks (Table 3). Male mortality rates are around 1.5 to 2.0 times the female mortality rates (for the same race) across all levels of education. Figure 1 graphically portrays the patterns in Table 3.

**Table 3**  
**1989-91 North Carolina Age-Adjusted Death Rates**  
**(per 100,000 population)**  
**by Race-Sex Group by Education**

<u>Years of School Completed</u>	<u>Females</u>				<u>Males</u>			
	<u>White</u>	<u>Black</u>	<u>Total</u>	<u>Black/White Ratio</u>	<u>White</u>	<u>Black</u>	<u>Total</u>	<u>Black/White Ratio</u>
0-8	991.9	1185.6	1049.0	1.20	1657.5	2084.1	1773.9	1.26
9-11	950.7	981.8	976.5	1.03	1605.0	2084.3	1721.2	1.30
12	721.6	1336.3	798.0	1.85	1423.8	2786.4	1585.2	1.96
More than 12	699.9	953.3	728.0	1.36	988.3	1406.7	1019.5	1.42
Total	806.8	1076.0	858.8	1.33	1348.2	1979.4	1455.5	1.47

Note: Standard population for age-adjustment is total 1990 North Carolina population (white plus black) by age.



# Figure 1

1989-91 North Carolina Age-Adjusted Death Rates (per 100,000 population)  
by Race-Sex Group by Education

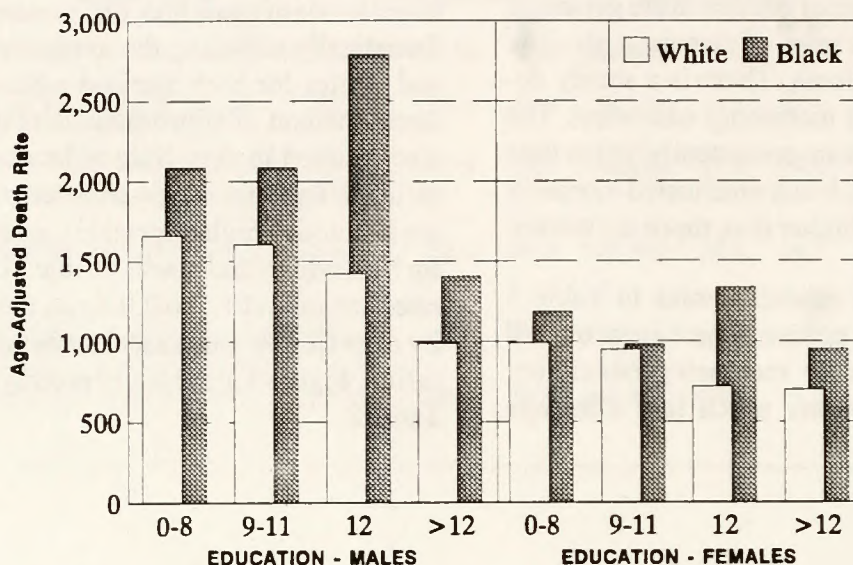


Table 3 and Figure 1 show a peculiar rise in age-adjusted mortality for both black males and black females with 12 years of education, with a sharp drop in mortality for those with more than 12 years of education. No such pattern is apparent in the white population. It is not clear whether this is a real phenomenon or a function of problems in the recording of education. This issue will be explored further in the Discussion section.

Examination of age-specific patterns of mortality provides additional information about racial and educational differences in mortality. Table 4 shows age-specific mortality rates by race and sex, along with the black/white rate ratios. It can be seen that the differences in mortality between blacks and

whites are much larger in the younger age groups. Table 4 also shows very large sex differences in mortality, particularly at the younger ages.

Table 5 shows age-specific mortality rates by education and sex, along with the ratio of the rates of the lowest and highest educational groups. This table shows that educational differences in mortality are much larger at younger ages. Table 5 also shows very large sex differences in mortality at the younger ages. Comparing the ratios in Tables 4 and 5 suggests that educational differences in mortality in North Carolina are generally larger than the racial differences in mortality. Other studies have also suggested that socioeconomic factors transcend race as predictors of health<sup>14,15,16</sup>.

**Table 4**

**1989-91 North Carolina Age-Specific Death Rates  
(per 100,000 population)  
by Race-Sex Group**

<u>Age</u>	<u>Black Females</u>	<u>White Females</u>	<u>Ratio</u>	<u>Black Males</u>	<u>White Males</u>	<u>Ratio</u>
25-34	136.1	57.2	2.38	360.7	141.6	2.55
35-44	260.2	106.3	2.45	604.6	208.0	2.91
45-54	578.2	254.4	2.27	1224.6	508.9	2.41
55-59	922.3	547.9	1.68	2065.8	1062.9	1.94
60-64	1487.1	871.5	1.71	2887.0	1665.1	1.73
65-74	2373.5	1578.4	1.50	4590.1	3063.6	1.50
75+	5854.4	5886.7	0.99	8801.6	8412.8	1.05

**Table 5**

**1989-91 North Carolina Age-Specific Death Rates  
(per 100,000 population)  
by Sex by Education**

<u>Age</u>	<u>Females</u>					<u>Males</u>				
	<u>Years of School Completed</u>					<u>Years of School Completed</u>				
	<u>0-8</u>	<u>9-11</u>	<u>12</u>	<u>&gt;12</u>	<u>Ratio*</u>	<u>0-8</u>	<u>9-11</u>	<u>12</u>	<u>&gt;12</u>	<u>Ratio*</u>
25-34	177.4	110.6	115.7	42.1	4.21	391.7	291.4	275.8	80.8	4.85
35-44	288.1	214.5	186.7	83.6	3.45	551.0	473.0	429.8	139.4	3.95
45-54	580.5	397.1	359.0	184.4	3.15	1029.8	805.7	798.8	324.4	3.17
55-59	904.1	658.2	654.1	401.9	2.25	1595.1	1427.0	1460.7	723.6	2.20
60-64	1235.6	1115.9	969.0	704.3	1.75	2240.1	2104.9	2105.3	1156.4	1.94
65-74	1982.7	2090.5	1492.8	1299.8	1.53	3802.8	4043.6	3270.4	2139.3	1.78
75+	6102.5	6184.0	5022.8	5836.0	1.05	8797.3	9102.4	8657.7	7085.3	1.24

\*0-8 years of education death rate divided by >12 years of education death rate.



## DISCUSSION

Several questions were posed earlier in this paper and the results presented above begin to address them. Blacks are approximately 40 percent more likely to die in a given year than whites (after adjustment for age differences) and this difference is not due primarily to the lower educational levels of blacks, on average, as compared to whites. Substantial racial differences in mortality persist at every level of educational attainment. There are substantial educational differences in mortality within each race-sex group: persons of the lowest educational level (0-8 years) are around 50 percent more likely to die in a given year than persons with some college education, after adjustment for age differences. Much larger differences in mortality by both race and education are observed at the younger age groups.

This study found an unusual rise in age-adjusted mortality for both black males and black females at 12 years of education. There is no reason to expect that blacks with 12 years of education would have higher mortality than blacks with 0-8 years of education. Differences in classification of education in the death versus the census data could contribute to this finding. If a substantial number of blacks had completed 12 years of education but did not attain a high school diploma, then they could be counted in the "12" category on the death certificate (numerator) and in the "9-11" category in the census data (denominator). This would result in the death rate for 12 years of education being inflated. Also, a study on the quality of educational data reported on the death certificate found that the number of decedents with 12 years of education (reported by next of kin) markedly exceeded counts from matched survey data on self-reported educational level, and concluded that death rates for those with 12 years of schooling might need downward adjustment<sup>17</sup>. This peak in mortality at 12 years of education was present in every age group for blacks, but was much more pronounced for both black males and black females over age 45.

This study suggests that educational differences between blacks and whites in North Carolina do not explain the higher mortality rates of blacks. Part of this finding may be due to the fact that education is imperfectly correlated with income and occupational status<sup>1,13</sup>, which are also important determinants of mortality. In 1983 the earning capacity of black college graduates was almost identical to that of white high school graduates<sup>18</sup>. Information on these dimensions of socioeconomic status might help explain the persistent racial differential in mortality, though there may be problems of interpretation due to the problem of reverse causation discussed above. One study has shown substantial errors in reporting education on the death certificate, probably resulting in a net over-reporting of educational level<sup>17</sup>, and so findings of the present study may be biased due to poor data quality.

Several factors could account for the higher mortality of blacks at each level of education found in the present study. Other studies have found unexplained racial differences in health after controlling for income and other known risk factors<sup>3,12</sup>. Health care access may be more limited for blacks, due in part to shortages of health care providers in black communities. At the same educational level as whites, blacks may have different occupational characteristics which could be associated increased worksite risks and with less adequate health insurance coverage, affecting access to health care. Several authors have suggested that racism and racial discrimination may be a factor in higher black mortality in the United States<sup>16,18,19,20,21,22,23</sup>. This could, for example, contribute to limited job opportunities for blacks, lead to restricted access to the health care system for blacks<sup>24</sup>, or result in blacks being treated differently by medical care providers<sup>25,26,27</sup>. Barriers associated with minority status could also produce higher levels of stress resulting in increased hypertension<sup>13,28,29</sup> and negative health behaviors such as smoking<sup>30</sup>, alcohol abuse, or violence.

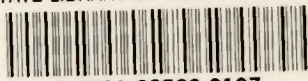


Terris<sup>31</sup> has called for “desegregating health statistics” and an emphasis on solving the health problems of different economic, occupational, or educational levels of the population, without regard to skin color. Krieger<sup>20</sup>, on the other hand, maintains that racial differences in health cannot be reduced to a question of social class; racial discrimination may mean that even within the same economic level, whites and blacks have different health status. Except for a few specific conditions, racial differences in health status are not biological in origin<sup>18,21</sup>. The observation of racial differences in health should prompt study of the various underlying social and economic causes. But even if racial differences in

health can be explained by income, occupation, health insurance, racial discrimination, etc., it should not be forgotten that “the unadjusted difference is the disease burden actually borne by blacks”<sup>18</sup>. Successful measures to improve the health status of blacks must reduce this absolute difference.

In summary, the present study shows strong racial differences in mortality after controlling for education, and suggests that sex, age, social class, and factors associated with race all strongly contribute to differences in mortality among residents of North Carolina.





## REFERENCES

1. Kitagawa EM, Hauser PM. Differential mortality in the United States: a study in socioeconomic epidemiology. Cambridge, MA: Harvard University Press; 1973.
2. McCord C, Freeman HP. Excess mortality in Harlem. *The New England Journal of Medicine*. 1990;322:173-177.
3. Otten MW, Teutsch SM, Williamson DF, Marks JS. The effect of known risk factors on the excess mortality of black adults in the United States. *Journal of the American Medical Association*. 1990;263:845-850.
4. Syme SL, Berkman LF. Social class, susceptibility and sickness. *American Journal of Epidemiology*. 1976;104:1-8.
5. Nelson MD. Socioeconomic status and childhood mortality in North Carolina. *American Journal of Public Health*. 1992;82:1131-1133.
6. Antonovsky A. Social class, life expectancy and overall mortality. *Milbank Memorial Fund Quarterly*. 1967;45:31-73.
7. Pratt L. The relationship of socioeconomic status to health. *American Journal of Public Health*. 1971;61:281-291.
8. Feldman JJ, Makuc DM, Kleinman JC, Cornoni-Huntley J. National trends in educational differentials in mortality. *American Journal of Epidemiology*. 1989;129:919-933.
9. Pappas G, Queen S, Hadden W, Fisher G. The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. *The New England Journal of Medicine*. 1993;329:103-109.
10. Haan M, Kaplan GA, Camacho T. Poverty and health: prospective evidence from the Alameda County study. *American Journal of Epidemiology*. 1987;125:989-998.
11. Keil JE, Sutherland SE, Knapp RG, Tyroler HA. Does equal socioeconomic status in black and white men mean equal risk of mortality? *American Journal of Public Health*. 1992;82:1133-1136.
12. Wise PH, Kotelchuck M, Wilson ML, Mills M. Racial and socioeconomic disparities in childhood mortality in Boston. *The New England Journal of Medicine*. 1985;313:360-366.
13. James SA, Strogatz DS, Wing SB, Ramsey DL. Socioeconomic status, John Henryism, and hypertension in blacks and whites. *American Journal of Epidemiology*. 1987;126:664-673.
14. Guralnik JM, Land KC, Blazer D, Fillenbaum GG, Branch LG. Educational status and active life expectancy among older blacks and whites. *The New England Journal of Medicine*. 1993;329:110-116.
15. Navarro V. Race or class versus race and class: mortality differentials in the United States. *The Lancet*. 1990;336:1238-1240.



16. Editorial. Not a classless society. *The Lancet*. 1991;338:1116.
17. Shai D, Rosenwaike I. Errors in reporting education on the death certificate: some findings for older male decedents from New York State and Utah. *American Journal of Epidemiology*. 1989;130:188-192.
18. Cooper R, David R. The biological concept of race and its application to public health and epidemiology. *Journal of Health Politics, Policy and Law*. 1986;11:97-116.
19. Ayanian JZ. Heart disease in black and white. *The New England Journal of Medicine*. 1993;329:656-657.
20. Krieger N. Analyzing socioeconomic and racial/ethnic patterns in health and health care. *American Journal of Public Health*. 1993;83:1086-1087.
21. Sheldon TA, Parker H. Race and ethnicity in health research. *Journal of Public Health Medicine*. 1992;14:104-110.
22. David RJ, Collins JW. Bad outcomes in black babies: race or racism? *Ethnicity and Disease*. 1991;1:236-244.
23. Hogue CJR, Hargroves MA. Class, race, and infant mortality in the United States. *American Journal of Public Health*. 1993;83:9-12.
24. Blendon RJ, Aiken LH, Freeman HE, Corey CR. Access to medical care for black and white Americans: a matter of continuing concern. *Journal of the American Medical Association*. 1989;261:278-281.
25. Becker LB, Han BH, Meyer PM, et al. Racial differences in the incidence of cardiac arrest and subsequent survival. *The New England Journal of Medicine*. 1993;329:600-606.
26. Whittle J, Conigliaro J, Good CB, Lofgren RP. Racial differences in the use of invasive cardiovascular procedures in the Department of Veterans Affairs medical system. *The New England Journal of Medicine*. 1993;329:621-627.
27. Wenneker MB, Epstein AM. Racial inequalities in the use of procedures of patients with ischemic heart disease in Massachusetts. *Journal of the American Medical Association*. 1989;261:253-257.
28. James SA. Psychosocial precursors of hypertension: a review of the epidemiologic evidence. *Circulation*. 1987;76(suppl I):60-66.
29. Fray JCS, Douglas JG, ed. Pathophysiology of hypertension in blacks. New York: Oxford University Press; 1993.
30. Fiore MC, Novotny TE, Pierce JP, et al. Trends in cigarette smoking in the United States: the changing influence of gender and race. *Journal of the American Medical Association*. 1989;261:49-55.
31. Terris M. Desegregating health statistics. *American Journal of Public Health*. 1973;63:477-480.



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